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# LIGHTING DATA BULLETIN LD 131B

## Electric Sign, Poster Panel, and Bulletin Lighting



EDISON LAMP WORKS  
OF GENERAL ELECTRIC COMPANY

GENERAL SALES OFFICE  
HARRISON, N. J.



# Electric Sign, Poster Panel, and Bulletin Lighting

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*Information Compiled by*

E. B. FOX

*Engineering Department*



That progress in "Sign Advertising" has been great may be shown by comparing a modern exposed lamp and flood-light display with an overhanging sign of a popular bakery in Pompeii before the destruction of the city in A.D. 79.



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For information regarding MAZDA lamps and lighting questions, refer to the nearest sales office.

To make sure that you receive all bulletins, notify the Department of Publicity, Edison Lamp Works of General Electric Company, Harrison, N. J., of any change of address.

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# *Electric Sign, Poster Panel, and Bulletin Lighting*

*Compiled by E. B. Fox  
Commercial Engineering Section*

## *Why Use Electric Signs?*

Modern advertising must be "alive" with appeal and attraction. It should identify a product or locate a place of business. Widely varying forms of advertising have been used, ranging from a few lines of newsprint to great demonstrations and displays, each of which has its advantages.

## *A Natural Impression Medium*

Electric signs of all types constitute one of the strongest mediums of present day advertising, as they appeal to the observer at or near the point of sale.

## *Low Cost*

The value and cost of other forms of advertising, such as direct mail, newspapers, and magazines, is well known, but due to being less informed in regard to electrical advertising, many merchants and publicity men believe signs to be more expensive. Actually electric sign advertising costs less for the number of people appealed to than do the above mentioned forms. This, of course, does not mean that other forms of advertising should not be used, but it does mean that electric signs should be investigated and used to supplement other publicity programs wherever possible.

A progressive town or city is one well supplied with good electrical displays and receives many benefits from them. Manufacturers and commercial establishments are realizing more and more the value of electric signs, which, when properly designed, attract the attention of everyone passing within the range of the display.

For the manufacturer, a sign provides the opportunity to tell the public what he makes and where he makes it



Fig. 1. Vivid and striking against the dark background of the sky, spectacular electric advertising compels instant attention. This attractively designed large sign, of the exposed lamp type, requires hundreds of lamps.

Also, large displays present a spectacular sight that cannot fail to "burn in" their message and at the same time remind the observer, once more, of a familiar trademark.

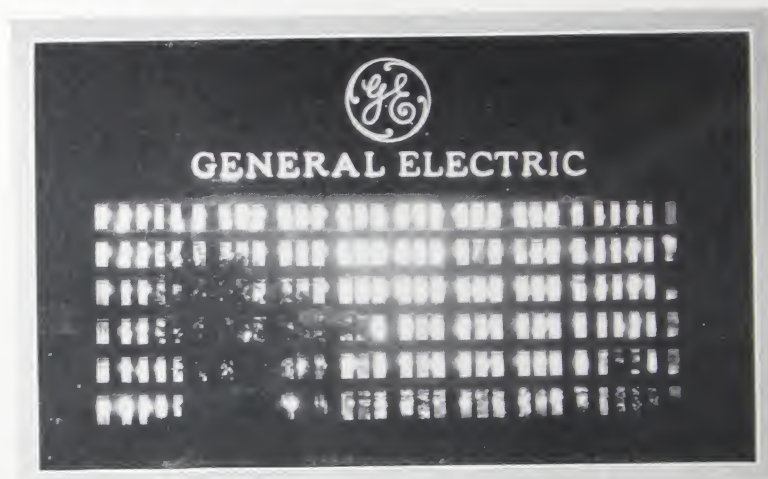


Fig. 2. Electric signs are not confined to business thoroughfares, but also find extensive use on manufacturing plants. This large display is 170 ft. long with letters 10 ft. high and is surmounted by a monogram 35 ft. in diameter. Fifteen hundred 25-watt blue sign Mazda lamps on 6 inch centers are used in this installation.

If people seldom pass the manufacturer's factory, the factory can be taken to them. A large electric sign can be read for many miles, or may be located at points of heavy circulation even if the factory is not there.





Fig. 5. This lamp studded typewriter, very realistic in appearance with its apparent motion, tells its story nightly on the "Great White Way."

Electric signs work for the advertiser day and night on those people who do not take or find sufficient time to read other forms of advertisements.



Fig. 4. Large business enterprises strive to keep their names before the public in a dignified manner, avoiding the unsightly and blatant displays too often encountered. This example is a full size, single, painted bulletin illuminated with seven angle reflectors and 150-watt Mazda C lamps. Attention was given to the matter of lattice work in order that the display should have the proper setting.

Constant repetition, one of the primary functions of outdoor advertising, is fulfilled by electric signs. The light they cast around their location protects both the public and the advertiser's factory.



FIG. 5. The large advertising firms construct and maintain electrically lighted signs whose advertising value is not lessened in the daytime.

Good displays attract the attention of people on the opposite side of the street and usually for many blocks in either direction. These people at a distance are the ones that your windows cannot attract.

Well designed and neat appearing signs serve to remind the passerby of what you sell and where you are located.

FIG. 6 (right). A good example of what can be done with hidden light sources in silhouette signs. A broader letter stroke would have been better, as the very narrow strokes disappear on signs of this type when viewed at considerable distances.



FIG. 7 (left). Unique design often makes a large display doubly effective.



FIG. 8. Attention is often held by the mammoth reproduction, in electrical advertising, of some familiar object. Here, in Broadway's well-known cigar display, are combined soft colors and floodlighting.

People like prosperous looking stores—an electric sign is a sign of prosperity and marks a progressive merchant.



FIG. 9. The smaller stores find well designed electric signs powerful agents in attracting customers. This combination of store front and swinging sign shows clearly the advantage of detail and harmonizing design for daytime appearance of small signs.





FIG. 10 Distinctive characterizes this sign, which is of the transmitted-light opal letter type topped by a neat in direct-light canopy. Small stores are giving more and more attention to the design of their displays.

Many electrical displays help make a town or city look more prosperous and wide awake.

They also furnish additional illumination on the street that will help to keep people downtown, looking at the advertisers' show windows after dark.



FIG. 11. This up-to-date city square embraces all types of displays, which increase the value of the adjacent properties as well as those in the square.

The great amount of light given off by many signs and marquees provides one of the best forms of protection, after dark, for the public, and for places of business in the vicinity.





FIG. 12 A full length overhead reflector sign gives good day and night appearance when properly proportioned. This one was equipped with 50-watt MAZDA lamps on 6-inch centers.

Carefully designed and well illuminated displays are as valuable in the daytime as they are at night and refute the belief sometimes expressed, that signs detract from the beauty of fine architecture.



FIG. 13 The theatre marquee, which is the attraction board of the house, when showered with light has the power of a great magnet upon the public. The new 25-watt inside frosted MAZDA lamps are literally packed into the under side of this marquee.



FIG. 14. This exceptional display stands as a convincing example of what can be done in the way of higher class roof structures. The illumination is provided by exposed lamp letters with floodlights behind the parapet wall to cover the framework.

### *Important Elements to Consider in Selecting a Sign*

An electric sign properly designed will have the power of attraction. This attraction often results from the mere fact that an electric sign is a brightly illuminated spectacle against a dark background.

#### *Brightness, Color, Motion*

As the illumination of the surrounding district increases, the brightness of a sign is not alone sufficient to make it stand out. However, we have two additional properties of attraction to fall back on, namely, the use of motion and color.

Very neat and attractive borders of a variety of types can be built and their attractiveness improved by the proper manipulation of flashers. Words and groups of words can also be made to flash in any desired sequence, thus adding materially to the attracting power of the whole sign.

It is generally desirable to give a different and usually more pleasing touch to the display by the use of harmonizing colors. It should be remembered that colors absorb much of the light given off by the lamps, and consequently the viewing distance for colored displays is less than that for clear lamp displays. At short viewing distances, however, color adds greatly to an otherwise unfinished display.

### *Careful Wording*

The efficiency of a sign, that is, its ability to advertise effectively, is governed by several factors. One of these factors is the ease with which it can be read. The wording should be carefully chosen, and indicate clearly just what is meant, for the average sign is usually read quickly or from a considerable distance.

### *Impressiveness*

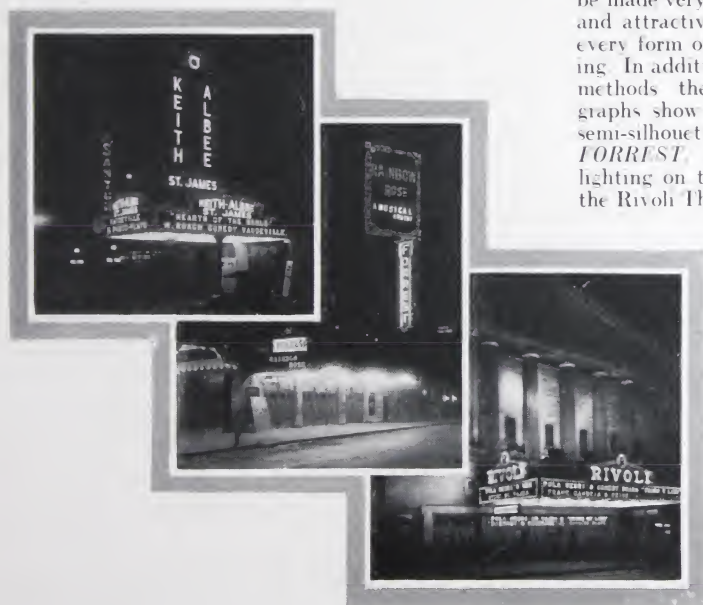
Due to the competition for attention, a sign should have some distinctly outstanding feature and be designed so that it is adapted to the use of color and motion, and preferably of sufficient size to dominate its surroundings.

The above points indicate some of the important properties of an efficient sign, but there are other things to be considered when laying out the specifications of a sign for any particular location or purpose.

### *Location and Circulation*

The items of location and circulation should be given much thought, as it is upon these points that the direct value of any display depends.

FIG 15. Theatre signs as shown at the left can be made very distinctive and attractive in nearly every form of sign lighting. In addition to usual methods these photographs show the use of semi-silhouette letters in *FORREST*, and flood lighting on the front of the Rivoli Theatre.





### *Legibility*

Care should be taken to provide for good legibility, which is governed by designing the sign properly to take care of the distance and the purpose for which it is intended. It is also important to have a sign of pleasing appearance both lighted and unlighted.

### *Appearance*

Frequently signs are designed only for the lighted effect. The value of such signs can usually be increased by paying more attention to daytime appearance. Wherever possible it is advisable to build the display to harmonize with the architecture of the building.

### *Maintenance*

A feature of the greatest importance is that of maintenance. Often signs have been erected and allowed to deteriorate because no provision was made for maintenance. A sign that is well kept and properly lighted makes a good impression, invites the prospective customer to come in and look over the merchandise, and assures him that he is dealing with a reputable firm. A poorly maintained sign cheapens the street and the store or factory using it. Such a sign never attracts or conveys the idea of an up-to-date place of business. Consequently it cannot be urged too strongly that, first, a good sign of pleasing design be erected, and, second, that it be fully maintained.

Maintenance consists of washing and repainting a sign whenever necessary, and relamping as soon as possible all burnouts that may occur. The amount of time necessary to give to sign maintenance depends somewhat upon the locality in which the sign is used. Many signs will be kept in good condition if washed or cleaned once in two months and repainted once a year, while others, due to atmospheric or other local conditions, require cleaning at least once a month and repainting twice a year.

It is always advisable to check up the sign for burned-out lamps when it is thrown on each night. Any burnouts that may be found should be replaced at that time. General repairs should be taken care of during the time of painting unless they require immediate attention.

### *Wiring*

Care should be taken when building a sign to wire it with well divided circuits that produce the least possible voltage drop.



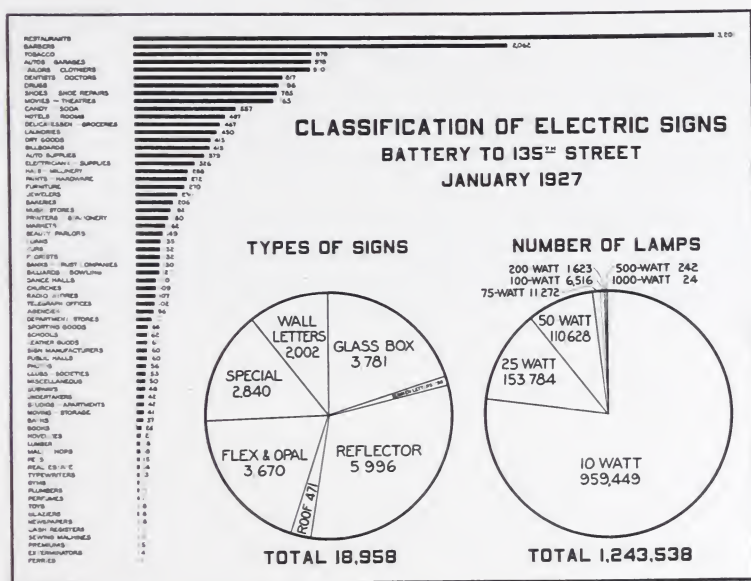
as a slight drop in voltage will materially reduce the light output of the lamps. It is also best to wire the circuits heavily enough to provide for at least twice the load planned, as it is often desired to relamp the sign with colored or other higher wattage lamps. Colored lamps should necessarily be of higher wattage than clear glass lamps, due to the absorption of some light by the colors.

It is always worth while to use galvanized angle iron and galvanized iron or copper sheets for outdoor signs, as these metals withstand weather conditions very satisfactorily.

## Classification of Electric Signs

Battery to 135th Street

January, 1927



The New York Edison Company

Bureau of Electric Signs

130 East 15th Street

FIG. 16 The classification of electric signs in New York City by the Bureau of Signs, of the New York Edison Company, gives some very interesting information as to classes of business using this method of advertising and the types of signs and wattage of lamps.

### Types of Signs

Electric signs are made in many forms, so it is desirable to group them by some outstanding feature for analysis. This has been done with the form of illumination as the designating feature.

1. Exposed Lamp or Direct Light.
2. Transmitted Light or Translucent Front.
3. Indirect Light or Reflected Light, under which there are two divisions, one being signs of a decorative nature and the other painted bulletins and paper poster panels.
4. An additional type sometimes used for special conditions may be known as the projected light.



FIG. 17. Raised opal letters applied to a changeable marquee provide a dignified method of effective advertising

### *General Use According to Types*

Taking each of the groups of signs given in the four main classifications we find that each group is best suited for the following applications:

Exposed lamp signs should be used for large displays, such as roof or wall signs (Figs. 1, 2, 3, and 14) where the advertiser wishes to cover great distances and produce an impressive effect.

Transmitted light and indirect light (decorative type) signs are best applied to small signs (Figs. 6, 9, 10, and 12) where the viewing distance is less than 2000 feet. Signs of this size require a smooth appearance which is often difficult to obtain with exposed lamp signs.

Indirect light signs illuminated by angle reflectors and flood-lighting units (Figs. 4, 18, and 27) are for the most part painted

bulletins and walls and poster panels. This type is not as effective for long distance viewing as the exposed lamp sign, but provides opportunity for color and detail work at shorter distances.

Projected light signs throw pictures of various sizes but are limited to relatively short viewing distances and are of a special nature.



FIG. 15. The above installation of floodlighting a novel sign continually attracts the attention of a great many commuters.

Interior displays which are steadily increasing in popularity may be found under any of the above classifications, but are found in most cases to be some form of the transmitted light type.

Interior signs are usually one of the three types shown on page 18. These are popular in large office buildings, theatres, stores, hotels, railroad stations, and public buildings. The chief purpose of such signs is to act as a marker or to give other kinds of information. An equally large field has been opened up recently, and might be called indoor advertising.

Interior signs for advertising have been thought too costly or have been overlooked in the past, but have finally entered this large field and are producing very successful results. Interior displays can be made with great refinement of detail and much decoration as they are used for short viewing distances and are not subjected to severe weather conditions.



-CHANGEABLE---EFFECTIVE-

DISCOUNTS

IN OUR  
SPECIAL  
INTEREST  
DEPARTMENT  
  
INTEREST  
COMPUTED  
MONTHLY AT 3%

DISCOUNTS

-CHANGEABLE---EFFECTIVE-

FIG. 19. Interior signs are usually one of the three types shown above. The sign reading *Changeable—effective* is equipped with tapes of complete alphabet and numerals on rolls, providing an easy method of changing the wording. In the *Discount* sign, a new form of the etched glass type is shown in which a very pleasing appearance is presented by backing the etched characters with silver-leaf or gold-leaf. The third sign, calling attention to the Special Interest Department, is of a very popular type and consists of small glass letters set in a metal face.



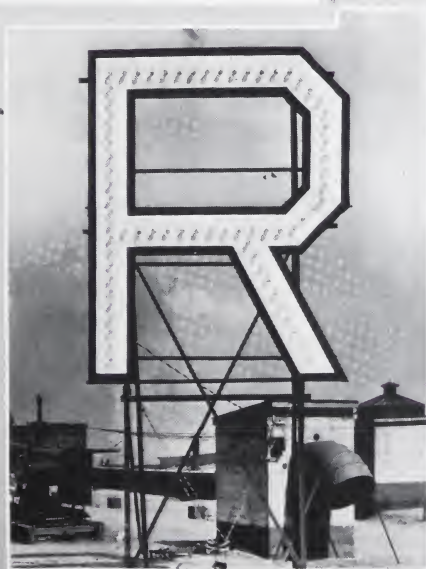


FIG. 20 (left) With careful designing, a sign harmonizes with its architectural surroundings



FIG. 21 (center) Perforated pasteboard models assist in determining proportions of the display

FIG. 22 (right) Black borders around each letter provide a background to increase daytime visibility



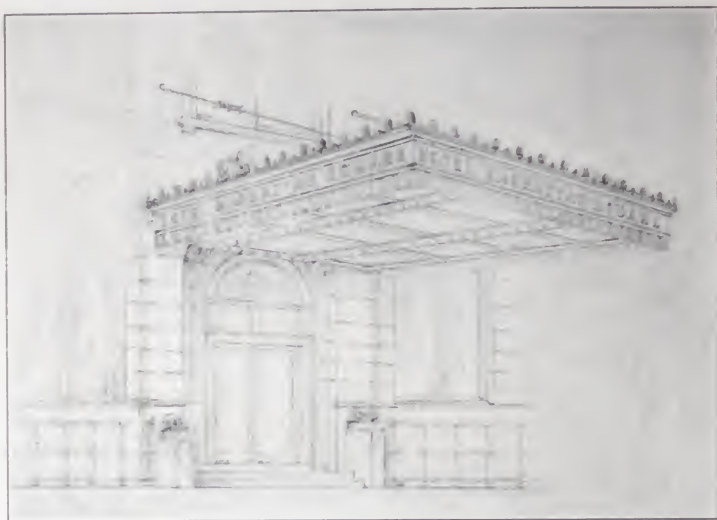


FIG. 23. The prospective purchaser of a sign may realize how the installation will look by including in the sketch the main lines of adjacent structures. Compare this sketch with the completed installation shown on the preceding page.

### *Design*

There are a few fundamental principles which should be followed in order to insure an efficient and effective sign. Artistic and decorative schemes should be secondary features, with clearness and legibility as the primary objects.



FIG. 24. To lessen the chance of breakage which may be caused by rain striking the "hot spot" of gas-filled lamps burned horizontally in exposed lamp signs, small, inexpensive metal caps may be used.

FIG. 25 (right) Angle reflectors improperly placed destroy the appearance of any display.

FIG. 26 (below) Script should not be used on exposed lamp signs unless the display is a large one, thus providing a very narrow letter stroke as compared with other dimensions.



Exposed lamp signs depend upon their size and lamp spacing for clearness and smoothness of appearance. The proper dimension of a sign for a given range of distances can be obtained from the tables in the back of this bulletin.

The illuminated parts of a sign fade or blur at varying distances, depending upon their dimensions, intensities or colors used and background brightness. Proportions for the most effective results are as follows: letter height 100 per cent, letter width 60 per cent, spacing between letters 40 per cent and letter stroke (where letters are the illuminated part of the sign)  $1/10$  to  $1/6$  of the height, (where the background is the illuminated part of the sign)  $1/6$  to  $1/4$  of the height.

In transmitted light and indirect light signs, the lamp spacing is largely determined by the nature of the sign and the materials used. It is, however, of prime importance to use a sufficient number of lamps to give an evenly illuminated display.





FIG. 27. The posting industry is gradually standardizing on single and double units. The above photographs show typical double units for both poster panels and painted bulletins.

Poster panels and painted bulletins are fairly well standardized as to their specifications at the present time. A standard poster panel is 25 ft. long and 11 ft. high and may be well illuminated by three angle reflector units with lamps of sufficient size to give a contrast between the panel and its surroundings.

Painted bulletins may be of various shapes and sizes, but are usually 35 to 50 ft. long and about 12 ft. high. Good illumination can be provided by angle reflectors furnished with the proper size lamps. The number of reflector units required will be the same as for a poster panel in proportion to the length, that is, a bulletin 50 ft. long will take seven units.

In general angle reflector units should be located directly in front of the top of the display, the distance out being 50 to 60 per cent of the height of the display, and the spacing between units 60 to 70 per cent of the display height. The 10 per cent variation of position in either direction will allow for the various types of angle reflectors. Recommendations are also made in some cases for placing the reflectors on a line slightly above the top of the display.





### *Edison MAZDA Lamps*

Various experiments and considerable use of the new inside frosted bulb, Edison MAZDA lamps, have shown them to be excellent for sign illumination.

Exposed lamp signs may be equipped with a wide range of lamps but the following are particularly recommended in the 110 to 120-volt range.

FIG. 28 The 100-watt A-23 bulb inside frosted MAZDA lamp has given excellent results in bulletin and poster panel lighting. Gas-filled MAZDA lamps in the larger sizes up to 1000 watts have been successfully used for this service.

### *Color*

The 15-, 25- and 40-watt New Standard Line Edison MAZDA Lamps should be used for all displays designed for these wattages where a smooth evenly illuminated letter is required. Color media can be applied to these new lamps as satisfactorily as to the old clear glass lamps.

Color should be used extensively wherever white or uncolored signs appear in any great number, because this creates a pleasing as well as an effective contrast. Spray coated colored lamps are very popular because they give off diffused color and are as easily replaced as uncolored lamps.

It has been difficult, however, to obtain spraying material in all colors which will not be affected by weather conditions. These spray coatings resist weather better than any other superficial coating now used, but the question of fading enters into the use of such colors as red and blue.

In cases where permanent color is necessary, color hoods or natural colored glass lamps should be used.

### *Blue Sign Lamps*

If one wishes to obtain a bright sparkle and a whiter effect, the popular blue sign MAZDA B lamp can be obtained as formerly



FIG. 29 The sparkle and whiter appearance of the blue sign MAZDA B lamps make them popular with the advertiser.

(Left) 15-watt, S-14 clear blue sign, MAZDA B lamp

(Right) 25 and 50-watt, A-19, clear blue sign, MAZDA B lamp

without the inside frosted finish. These lamps are furnished in three sizes, 15-watt, S-14 bulb, 25-watt, A-19 bulb, and the 50-watt, A-19 bulb.

### *MAZDA C Lamps*

The trend in recent years has been toward the higher wattage gas-filled MAZDA lamps. These lamps, of course, become very hot directly over the filament when burned in a horizontal position and unless protected to some degree, as by color hoods, are apt to fail because of water cracks, caused by rain or snow falling on this hot spot. For this reason these lamps are not recommended for use in signs unless protected from the weather. Many advertisers, however, are willing to stand the loss in order to get the added brightness of the gas-filled lamps. The use of the small protecting cap, illustrated in Fig. 24, is usually found to lessen the breakage from this cause. The type of advertising which requires a lamp of this size and intensity is so valuable that the increased cost of replacements is of little concern. It is suggested that such installations be furnished with the new 60- or 100-watt, Edison MAZDA lamps.

Transmitted light signs, of which the most important form is the raised opal letter, usually require a whiter light than exposed lamp signs. For this reason, the new 60- and 100-watt Edison MAZDA lamps, in the daylight blue glass inside frosted bulbs are recommended. Here again the inside frosting of the bulbs is an advantage, as it does away largely with the spotty effect (unless this is caused by the lamp spacing being too great) which was often quite noticeable with the old clear lamps. The inside frost in the daylight bulbs not only assists in breaking up the filament spots, and consequently illuminating the sign more evenly, but also creates a light which appears whiter than was previously obtained with the unfrosted daylight lamps.

FIG. 39. The new 60-watt inside frosted bulb daylight MAZDA C lamp, gives a very white effect so often desired in transmitted light signs.



These lamps, of course, give off considerable heat, but it has practically no effect on their burnout life. The sockets and wiring used in a sign, however, are often affected by heat, and it is suggested that the ventilation of a sign be done in the chambers containing the back of the sockets and the wiring, instead of in the main chamber of the sign where the lamp bulbs are located.

#### *Lamps for Painted Bulletins*

Poster panels and painted bulletins should be illuminated with standard MAZDA C lamps ranging from 100 to 1000 watts in size. The proper size of lamp to use is determined by the surrounding brightness of the display. The majority of these displays found in relatively dark locations are illuminated with 100-watt lamps. When the new 100-watt, Edison MAZDA lamps appeared on the market, and were recommended for this type of lighting, some question was raised by the poster industry as to how well the



new inside frosted lamps would replace the clear lamps previously used. In order to determine the performance of the new lamps, an observation test upon two identical poster panels was arranged with a well known advertising concern



FIG. 31a (upper). Inside frosted lamps illuminate the panel on the reader's right, while an identical panel on the left is lighted by clear lamps. The uniformity and evenness of illumination given by the inside frosted lamps are readily discernible.

FIG. 31b (lower). By having the center lamp in each group unlighted, a comparison of the appearance of the panels with a burned-out lamp over each is obtained. The feather-edged cutoff obtained with the inside frosted lamps over the right panel is at once evident.

The results of the test were very gratifying and the decision of the observers was unanimous in favor of the new inside frosted lamps; because they apparently gave a whiter appearance to the display and brought out color values better, provided a more even illumination over the entire surface of the poster, and eliminated to some extent bright spots of direct reflection. In Figs. 31a and 31b are illustrated the panels upon which the test was conducted.

Indirect light signs of the decorative type may be equipped with any standard MAZDA lamp, depending upon the intensity of color desired. Sockets should usually be spaced on about six-inch centers, as evenness of illumination is very important.

#### *Lamps for Interior Signs*

Interior signs can be equipped with various types of standard lamps, but usually the dimensions of the signs are such that a



FIG. 32. Angle reflectors appear in many shapes as shown above, and all of these are used on poster panels and painted bulletins



FIG. 33. Retouched daytime photographs can be made to appear very realistic for determining the night appearance of a sign.

tubular lamp of small diameter is required. The lamp recommended for this type of service is the 25-watt, T-10 bulb Edison MAZDA B lamp which is about six inches long and one and one-quarter inches in diameter, as shown in Fig. 34.

### *Accessories*

#### *Flashers*

The production of different effects on a single sign is often desired. Rotating or thermostatic switches known as "flashers" supply this need and can be arranged to produce quite remarkable variations. Flashers of the rotating type are used for all sizes of signs and operate in a definite sequence. Thermostatic flashers are restricted to on-and-off flashing of relatively light loads except when used to operate relays.

Flashing is one of the most important methods of providing change and apparent motion for electric signs and should be used wherever possible unless a very dignified effect is required. Variable





resistance can also be used in connection with flashing and produces quite different results from the more common forms.

Large banks of lamps in borders of signs provide means of obtaining great variation of design when they are connected to special flashers.

FIG. 34. The 25-watt, T-10 bulb MAZDA lamp finds considerable use in interior signs.

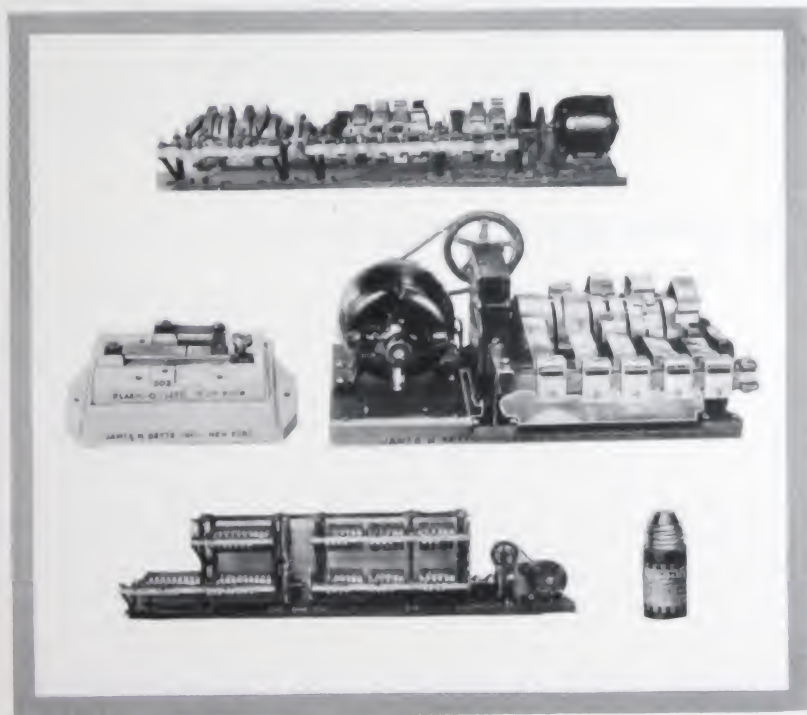


FIG. 35. Flashers in general use in modern displays vary from the simple thermostatic type to motor-driven designs with multiple circuits, through which heavy current loads are controlled.

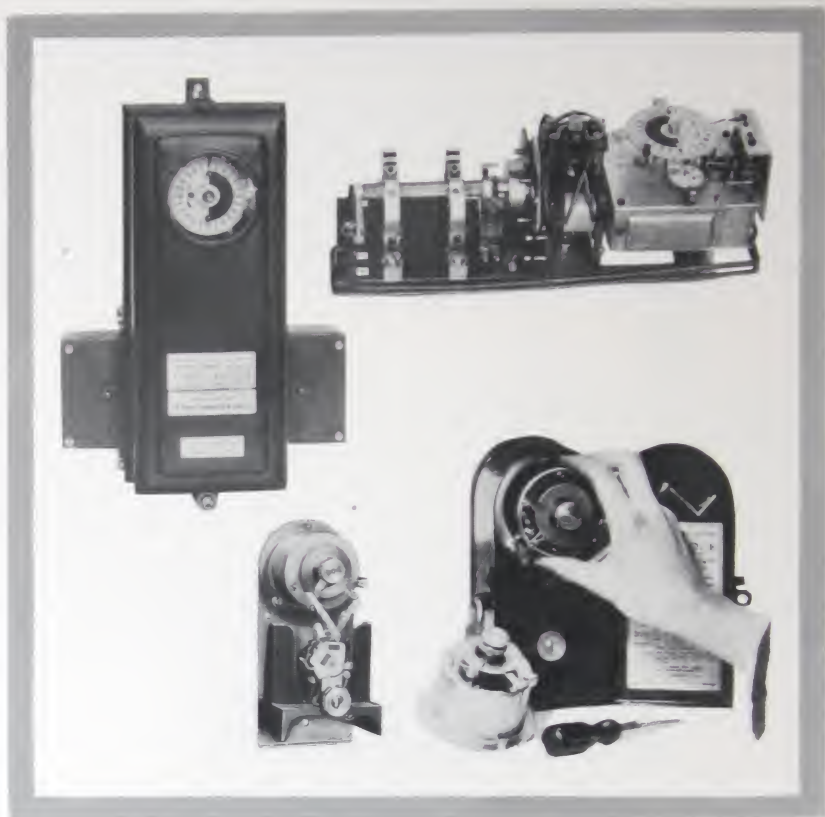


FIG. 36. Time switches may be obtained in a number of designs, the mechanisms ranging from the spring-driven, manually wound type shown in the lower illustrations, to the self-winding design in the upper.

### *Time Switches*

Electric signs are often located where it is inconvenient to turn them on and off each night. Time switches are available for this service and vary from the seven-day, single-pole type, to the self-winding, multi-pole type. Like other types of switches they are available for various loads or can be used to operate relays.

### *Color Hoods*

Sometimes several electric signs equipped with clear lamps will be found in a locality and because they are quite similar they fail to contrast noticeably with each other. Contrast of a pleasing nature is of course, advantageous, and can be readily produced by using harmonizing colors.



FIG 37 Colored glass canopies, known as color hoods and caps, are made in many forms and colors, principally for electric sign use.

A wide range of colors can be obtained by covering the lamps with colored glass canopies known as, "color hoods" and "color caps." These hoods and natural colored glass lamps are the only forms of permanent color media in use at present. A demand for color coated lamps has made it necessary to produce lamps with the most permanent coatings possible, but up to the present time it has been found difficult to get coatings for some colors that will stand up under both summer and winter weather conditions.

Color hoods and caps require more labor to install than do color coated lamps, but make it possible to have several colors on hand that can be changed at will without removing lamps.

Color hoods have sometimes been objected to as dust collectors, or, because they do not fit snugly against the face of the sign and allow a white ring of light to appear around the lamps. Recent developments in the design of color hoods, however, indicate that these objections will be done away with in the hoods of the latest design which screw into a threaded metal cup. It is probable that hoods will also be produced capable of housing and protecting high wattage lamps even under severe weather conditions. Color





FIG. 38. In a new design of color hood the lamp is enclosed in a dust-proof canopy. The hood is made in two parts: the metal base which is attached direct to the sign receptacle, and the glass hood which is screwed firmly into the supporting base half.

hoods can be furnished in a diffusing glass as well as in the clear glass.

### *Tables*

The following tables can be used for obtaining proper dimensions, sizes and spacings, when laying out signs.

If the size of letter or distance you are considering is not shown in the tables it can be easily found by estimating intermediate figures between those given.

The tables are based on plain letters (referred to in the paragraph on design) and clear or inside frosted lamps. If broader letter strokes than those given are used, in most cases the effective reading distance will be reduced. A change from clear lamps to colors may be compensated for by using higher wattage lamps.

Two things are of great importance in sign design.

First, that the letters are large enough to be easily and quickly read by a person with average vision at the distance from which you wish the sign to be effective.

Second, that the lamps be spaced so that they appear as a continuous band of light at the shortest distance from which the sign is to be viewed. In cases of low hanging signs in city streets it is sometimes impossible to accomplish this, but it can be approached by the use of lamps with diffusing coatings.

There is, of course, a minimum limit for the actual spacing of lamps, depending upon the size of the bulb or the socket, consequently where spacings shown on the tables are actually too small, the lamps should be spaced as closely as practical.

TABLE I

This table shows letters of the best proportions to obtain legibility at effective and maximum viewing distances for illuminated letter signs. (Letter stroke should be increased for silhouette signs.)

In many cases under good weather conditions exceptionally good eyes can read smaller letters at the distances given.

Effective Reading Distance	Maximum Viewing Distance	Letter Height	Letter Width	Letter Stroke	Space Between Letters
200'	400'	10"	6"	2 1/2"	4"
300'	600'	14"	8"	2 1/2"	5 1/2"
400'	800'	19"	11"	3"	7 1/2"
500'	1000'	2'	14"	4"	9 1/2"
750'	1500'	3'	2' 2"	5"	1' 2 1/2"
1000'	2000'	4'	2' 5"	6"	1' 7"
1500'	3000'	6'	3' 7"	9"	2' 5"
2000'	4000'	8'	4' 10"	12"	3' 2 1/2"
2500'	5000'	10'	6'	15"	4'
3000'	6000'	12'	7' 2"	18"	4' 9 1/2"
4000'	8000'	16'	9' 7"	24"	6' 5"
5000'	10000'	20'	12'	30"	8'

TABLE II

This table shows good lamp spacing for different degrees of surrounding brightness, for letters designed as those listed in Table I (exposed lamp signs).

## LETTER HEIGHTS

Surrounding Brightness . . . . . 10" 14" 19" 2' 3' 4' 6' 8' 10' 12' 16' 20'

## LAMP SPACING IN INCHES

Brightest (Times Sq., New York)	2½	2½	3	3	3	3½	3½	4	4	8	10	12	
Other Large City Squares	2½	2½	3	3	3	3½	3½	4	4	9	11	13	
Most City Squares	Bright	2½	2½	3	3	3	3½	3½	4	4½	10	12	14
	Medium	2½	2½	3	3	3	3½	3½	5	5	10	12	15
	Dim	2½	2½	3	3	3	3½	4	5	6	11	13	15
Business Sections	Bright	2½	3	3	3	3	4	4	6	7	12	14	18
	Medium	3	3	3	3	3	4	4½	7	7½	12	15	18
	Dim	3	3	3½	3½	3½	4	5	7½	8	13	16	20
Small Cities and Large Towns	3	3	3½	3½	3½	4½	5½	8	9	14	17	20	
Dark Factory Districts, Etc.	3	3	3½	3½	3½	4½	6	8	10	15	18	24	

NOTE.—In some cases the formulas used in obtaining these tables give results that show very wide spacing in large letters. In practice it is found that sign manufacturers do not often space lamps more than twelve inches apart, and we feel that it is best not to exceed this spacing.

TABLE III

This table shows the wattage lamps (based on standard inside frosted finish, or clear bulbs in the case of 10-watt MAZDA lamps) to use for different degrees of surrounding brightness, for letters designed as those listed in Table I (exposed lamp signs).

Surrounding Brightness	LETTER HEIGHTS											
	10"	14"	19"	2'	3'	4'	6'	8'	10'	12'	16'	20'
Brightest (Times Sq., New York)	15	15	25	25	25	25	50	50	50	50	60	100
Other Large City Squares	15	15	25	25	25	25	50	50	50	50	50	60
Most City Squares	Bright	15	15	15	25	25	25	25	50	50	50	60
	Medium	15	15	15	15	25	25	25	25	25	50	50
	Dim	15	15	15	15	15	25	25	25	25	25	50
Business Sections	Bright	10	15	15	15	15	15	15	25	25	25	25
	Medium	10	15	15	15	15	15	15	15	25	25	25
	Dim	10	10	15	15	15	15	15	15	15	25	25
Small Cities and Large Towns	10	10	10	10	15	15	15	15	15	15	15	25
Dark Factory Districts, etc.	10	10	10	10	10	15	15	15	15	15	15	15

TABLE IV

Recommended wattage of colored lamps to give about the same effect from the standpoint of advertising value as the different wattages of inside frosted MAZDA lamps listed at the top of each column.

LAMP	LAMP WATTAGE					
Inside Frosted	10*	15	25	40	60	100†
Blue Sign and Daylight Blue	15	15	25	50	60	100†
Yellow	10	10	25	50	60	100†
Amber-Orange	10	10	25	50	60	100†
Green	25	25	50	50	100†	150†
Red	25	25	50	60	100†	150†
Blue	50	50	50	60	150†	200†

\* Clear bulb.

† Require color hoods.

TABLE V

Recommended wattage of lamps for bulletin and poster panel illumination when used with angle reflectors and spaced according to suggestions in previous paragraphs.

Surrounding Brightness	Light and Medium Colored Displays	Dark Colored Displays
Brightest (Times Square, New York)	750	1000
Other Large City Squares	500	750
Most City Squares	Bright	500
	Medium	300
	Dim	300
Business Sections	Bright	200
	Medium	150
	Dim	150
Small Cities and Large Towns	100	150
Dark Factory Districts, etc.	100	150

MAZDA C lamps are recommended because of their higher efficiency and more concentrated filaments. When daylight lamps or colors of low absorption are used the total wattage on the display should be increased 150 to 200 per cent.



(Extract from 1925 "National Electrical Code.")

## ARTICLE 38. SIGNS AND OUTLINE LIGHTING

### 3801. General

a. The requirements of this article shall be deemed to be additional to, or amendatory of those prescribed in Articles 1 to 19, inclusive, of this code.

### 3802. Material

a. Metal used in the construction of sign boxes, cabinets or outline troughs shall be not less than No. 28 U.S. sheet metal gage (0.0156 inch). It shall be galvanized, treated with at least three coats of anti-corrosive paint, or otherwise suitably protected from corrosion.

b. With the exception of wood employed for the external decoration of signs and kept at least 2 inches distant from the nearest socket or receptacle, signs shall be constructed entirely of metal or other approved non-combustible material.

c. The design shall be such as to afford ample strength and rigidity, to render the box or trough practically weatherproof, to enclose all terminals and wiring other than the leads, and to provide drainage for each compartment by means of one or more holes, each not less than  $\frac{1}{4}$  inch in diameter.

d. A separate, completely enclosed accessible weatherproof approved box or cabinet shall be provided to contain cutouts, flashers, non-weatherproof transformers or other similar devices placed on or within the body or structure of a sign or on the exterior of a building.

e. Raceways shall not be employed for outline lighting.

### 3803. Sockets and Receptacles

a. Sockets and receptacles for sign and outline lighting shall be of the keyless porcelain type, and if for sign use shall be so designed as to afford permanent and reliable means to prevent turning. Terminals of sign receptacles shall be kept at least  $\frac{1}{2}$  inch from metal of the sign; provided, however, that where open work is employed as the wiring method, this separation shall be at least 1 inch. Miniature receptacles shall not be employed for outdoor work.

### 3804. Wiring

a. Wire of approved rubber-covered type, and not smaller than No. 14, shall be used.

b. Wires shall be neatly run and so disposed and fastened as to be mechanically secure.

c. Wires shall be soldered to terminals or receptacles, and exposed parts of wires and terminals shall be treated to prevent corrosion.

d. Approved bushings shall be employed to protect wires passing through walls or partitions of the structure. Sign leads not encased in conduit or metal armor may be cabled before passing through non-combustible, non-absorptive bushings.

e. Wires on outside of sign structure, except as provided in section 3805 of this code, shall be enclosed in approved conduit or metal armor. Where armor is employed an approved lead sheath shall be placed over the wire insulation.

f. Outline lighting shall be protected by its own cutout and controlled by its own switch.

g. Circuits shall be so arranged that the number of outlets and the lamps connected to them shall in no case be such as to place more than 15 amperes on the branch circuit fuse.

### 3805. Open Wiring

a. Open work may be employed as the wiring method for outline lighting and for signs on roofs or open ground, where not subject to mechanical injury.

b. Where wires are connected to approved receptacles which hold them at least 1 inch from the surface wired over, and which are placed at intervals not exceeding 1 foot, the receptacles themselves shall be considered to afford the necessary support and spacing of the wires. Where the interval between receptacles exceeds 1 foot but is less than 2 feet, an additional non-combustible, non-absorptive insulator maintaining a separation and spacing equivalent to the receptacle shall be used.

c. Where flexible tubing must be employed in outline lighting, the ends shall be sealed and painted with a moisture repellent and the tubing shall be kept at least  $\frac{1}{2}$  inch from the surface wired over.

### 3806. Grounding

a. Troughs used for outline lighting shall be grounded as provided in article 9 of this code.

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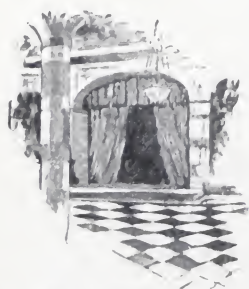
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